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UNCLASSIFIED- INFORMATION ON SOVIET BLOC INTERNATIONAL GEOPHYSICAL COOPERATION -1960

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INFORMATION ON INTERNATIONAL GEOPHYSICAL COOPERATION -- SOVIET-BLOC ACTIVITIES

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I. GENERAL

Discussion of a Grandiose Project for the Transformation of Nature

P. M. Borisov, an engineer, writing in the Literaturnaya Gazeta of 24 October 1959 proposed a project that would involve the blocking of Bering Strait with an enormous dam about 90 km long. Pumps of tremendous power would be installed there which would remove a vast quantity of cold water from the Arctic Ocean -- 500 km^3 per day -- and pump it into the Pacific Ocean. This removal would cause a deficiency to be supplied by the influx of warm Atlantic waters on the western side of the Eurasian land mass, an intensification of the Gulf Stream. The author claimed that this would be completely adequate to completely remove the ice covering the Arctic and cause a substantial warming of the adjacent coasts.

D. A. Drogaytsev answers Borisov point-for-point in an 8-page article appearing in the June 1960 issue of Priroda.

The first point he tackles is whether the ice cover would indeed disappear. The author of this critical review supplies the reader with a great deal of factual and statistical data concerning the horizontal and vertical distribution of temperature, currents, salinity, and other hydrological characteristics for various parts of the Arctic basin, it being impossible to discuss the problem posed by Borisov without a full comprehension of the ramifications of these facts. He demonstrates convincingly that the influx of oceanic waters would by no means accomplish the extraordinary transformation visualized by Borisov. Thawing of Arctic ice, he points out, is almost solely in response to heat received from the atmosphere overlying the ice surface -- 64% from warm air moving over the ice from the south and 36% from the direct and scattered radiation of the Sun.

After discussing the currents in the Arctic basin at some length, the reviewer points out a fact overlooked by Borisov. The creation of a current moving southward toward the Bering Sea and Strait as a result of the powerful pumping operation would not only draw vast amounts of water southward -- it would also bring incalculable volumes of ice southward which in an exceedingly short time would totally block the narrow strait from the surface of the sea to the very bottom of the strait. The ultimate effects of this would be catastrophic. The readjustment of surface currents in the Arctic Basin would soon drive enormous masses of ice onshore along the entire coast from the Laptev Sea to the Chukchee Sea, blocking the coast and the mouths of the great rivers all year round.

Borisov visualized that the removal of the Arctic ice would result in a striking amelioration of climate in the northern lands. Winter in Yakutsk would become like the present winter at Orel, and at Orel -- like that in Belgium. The reviewer cannot dispel this illusion for his reader without an extensive summarization of all the important climate-forming factors and a discussion of circulation of the

atmosphere over a large part of the Northern Hemisphere. He then points out that the amelioration of Arctic climate by the mechanism suggested would result in catastrophic results for other parts of the Soviet Union. Winters would be colder, summer would be hotter and precipitation would drop off. The arid zone of subtropical deserts of North Africa, Central Asia and the Gobi would move to the north. With the blockading of the northern coast of Asia by ice the tundra and Yakutia would become colder in the summer and the winter would doubtlessly remain unchanged. The constant pumping of cold water through the dam in the Bering Strait would change the hydrological regime of the northwestern part of the Pacific Ocean. The entire eastern shore of Asia would experience colder winters and ice conditions in Far Eastern waters would worsen.

The reviewer states that science is now in a position to fully analyze the results of the interference by man in the prevailing pattern of nature. "In evaluating any project, especially a grandiose one, one should not only examine the technical aspects of its accomplishment and the specific economic results. Indeed, by gaining in one way, it is possible to inflict irreparable harm to the Earth's environment." ("Warm Up the Northlands?" by D. A. Drogaytsev, Priroda, No. 6, 1960, pp. 39-42)

A Soviet "Mohole"?

The drilling of superdeep wells and related problems are examined in detail in an article by B. I. Vozdvizhenskiy, Moscow Geological Prospecting Institute imeni S. Ordzhonikidze, which appeared in a Soviet Geological periodical. The author begins his article with the statement, "In the next few years in our country the drilling of superdeep wells for studying the Earth's interior will be mastered." He follows this with a discussion of Project Mohole, the USA's plan to drill through the Earth's crust to the Mohorovicic discontinuity and study the plastic envelope of the Earth's nucleus.

The deepest wells in the Soviet Union today are close to 5 kilometers, says Vozdvizhenskiy, and the development of deep drilling is projected. Two such wells, for oil and gas, have already been planned for depths down to 7 kilometers (between the Volga and the Urals). In the future, the drilling of wells increasing in depth down to 10 kilometers and more must be carried out.

Vozdvizhenskiy discusses the problems arising in deep drilling, and the most suitable methods and equipment for performing such work. He lists a number of organizational and scientific-technical measures which must be put into practice for the rapid and successful mastering in the Soviet Union of drilling the deepest wells in the world. ("Some Problems of Superdeep Drilling," by B. I. Vozdvizhenskiy; Moscow, Izvestiya Uchebnykh Zavedeniy, Geologiya i Razvedka, No. 5, 1960, p. 128-136)

II. ROCKETS AND ARTIFICIAL EARTH SATELLITES

The Third Anniversary of Sputnik I -- Excerpts from the Soviet Press

Three years have passed since the launching of the first space vehicle on 4 October 1957. Numerous articles in the Soviet press have brought this anniversary to the attention of the Soviet people. These articles review Soviet triumphs of the last 36 months, praise the genius of the Soviet engineer and technologist, laud the purity of motivation of the Soviet government, and often contain more than a few derogatory remarks about their competitors in the space race.

N. Varvarov, writing on page 4 of Izvestiya on 4 October: "The attainments of the Soviet people in the creation of artificial heavenly bodies was made possible by the total development of Socialistic society, its economy and culture, science and technology.... The scientific information derived...by Soviet researchers is not kept secret but instead is widely publicized, put at the disposition of all humanity.... The United States keeps its results secret...safeguarding them for its own evil intents.... In the shining glory of Soviet science and technology, in the light of its peaceful aspirations, the actions of the United States appear pitiful and vile before the entire world; the United States is striving to use the greatest attainments of human genius for militaristic purposes. The ruling circles of the United States have seen in space a new possibility for sustaining the cold war and continuing an unrestrained arms race." Varvarov concludes his article, entitled "Attacking Cosmic Distances," with similar comments, much in the same tenor.

The astronomer I. Shevlyakov, writing in Krasnaya Zvezda on page 3, issue of 4 October 1960, states that with the return of the experimental animals from space the time is imminent for the sending of a man into space.... "But the Soviet Union is facing up to this problem with all historical responsibility. The flight will occur only when the full safety of the cosmonaut is ensured and his satisfactory return to Earth is guaranteed.... The Soviet Union is making flights into space exclusively for scientific purposes. Scientists are attempting to discover new laws of nature and direct them to the welfare of human society, in the long run to improve the life of man on Earth." In concluding his article, entitled "Three Years of Attack on Space," Shevlyakov writes "There is no doubt that the time is near when man will make flights to the Moon, to Mars and other planets of our solar system.... Three years of attack on space have demonstrated the unlimited possibilities of the human mind and the authority of man over the forces of nature."

Krasnaya Zvezda on 5 October 1960 carries an unsigned article on page 3 entitled "Third Anniversary of Man's First Breakthrough into Space." It reports that a meeting of the Academy of Sciences of the USSR had been held the previous day. The meeting was opened by Academician A. N. Nesmeyanov, President of the Academy of Sciences. Included

In his remarks was a statement that a new science had been born. This new science, he said, might be called the science of cosmic space or experimental astronomy. And, he continued "the Soviet Union has taken first place in the investigation of space and will never yield that place." (Three excerpts from the Soviet press, publications, authors and dates cited in text)

"The Spaceship and Science"

The following are excerpts from a recent article by Professor D. A. Frank-Kamenetskiy:

"A new science has been born before our eyes -- space electrodynamics. It studies electromagnetic fields in the Universe. It is well known that the most important electromagnetic phenomena are associated with streams of charged particles which arrive at the Earth from the Sun. They are in part trapped by the Earth's magnetic field and interact with the ionized layers of the upper atmosphere. The successes attained in the mastery of space have already made an immense contribution to space electrodynamics."

"The spaceship possesses very great possibilities for the making of scientific observations, in this respect far exceeding all former sputniks. There is no question but its scientific information will make it possible to considerably widen and deepen our knowledge of the complex processes of collision of solar corpuscular streams with the Earth's magnetic field and of changes in the radiation belts and the ionosphere."

"It was recently reported (Priroda, 1960, No. 4, p. 70) that observations show that after solar flares there is a change in the velocity (by a small amount) of the Earth's rotation on its axis. This is presumably related to magnetic forces. This is an example of what surprising phenomena may result from the effects of space electrodynamics!"

"A spaceship can be of invaluable service in the study of other distant heavenly bodies even before they can actually be reached in flight. The Earth's atmosphere causes incalculable difficulties for astronomical observations. Spaceships, in no way differing from that launched on 15 May, can already be equipped with powerful telescopes."

"Still another new science is that of nuclear astrophysics. It is also awaiting the assistance of spaceships. Theoretical considerations have led to deductions concerning various nuclear processes which should transpire in stars at various stages in their development. It would be extremely valuable to check these calculations experimentally. The spaceship can help to do this." ("Spaceship and Science," by Prof. D. A. Frank-Kamenetskiy, Priroda, No. 6, 1960, pp. 3-4)

What "Layka" Did for Space Medicine

A recent article appearing in Priroda deals with the results derived by space medicine from the flight of the dog "Layka," and its applicability to development of a spaceship environment suitable for

the flight of man into space. This rather brief and superficial article, containing largely out-dated information, was authored by P. K. Isakov, Candidate in Biological Sciences, Chairman of the Committee on Space Medicine of the Astronautics Section of the All-Union Voluntary Society for the Promotion of the Army, Aviation, and Navy (DOSAAF). ("Tests of the Spaceship," by P. K. Isakov, Priroda, No. 6, 1960, p. 4)

Telegraphic and Telephonic Systems for Communication with Space Vehicles

It may be said, says the August 1960 issue of Nauka i Zhizn', that the problem of launching a man into space has been essentially solved, but with a few difficulties still remaining. Such a flight cannot be experimental, its success must be guaranteed. One of the remaining problems is the development of a reliable, high-quality two-directional system of communication with the cosmonaut.

The principal barrier is the ionosphere. The concentration of ionized particles at various elevations is not homogeneous. At heights from 60 to 400 km it has several maxima and minima. The Earth is surrounded, therefore, with several layers with a high concentration of ionized particles. In ionized air radio signals are propagated at a lesser velocity. A decrease in velocity causes the signals to be distorted. Signals sent from the Earth to a spaceship may never reach it, being refracted by the ionosphere in such a way that they are reflected from it as if from a mirror. Everything depends on the angle of incidence and the length of the wave. The more slanting is the radio beam the easier it is for it to be reflected; the shorter the wave the easier it is for it to penetrate into the ionosphere.

Presently existing communication facilities are inadequate to insure uninterrupted communication over thousands and millions of kilometers with transmitters of only a few dozen watts power.

What wave length should be used in the future? Those longer than 100 meters cannot be used because they simply cannot break through the ionosphere. Those in the range of 10 to 100 meters will have to be used. The reception of radio signals on short waves (on the order of 15 meters) from Earth satellites has shown that communication is not disrupted even when the transmitter is on the opposite side of the Earth. But the level of the signal is notably weakened with an increase in distance, although at distances greater than 8,000 km it suddenly grows stronger again.

Communication with spaceships can also be accomplished on waves shorter than 10 meters. But in this case it is necessary to have artificial satellites as relay stations or the Earth must be covered with a network of receiving stations situated in such a way that the spaceship will not be lost from the field of vision. The Moon can also be used as a relay station but a station would have to be situated on its surface.

Radio waves of less than 2-3 cm cannot be used for radio communications in space because they are absorbed by the lower layers of the atmosphere and water vapor and are scattered by the ionosphere.

The article then discusses the telegraphic system of communication that has been used up to the present time to communicate with all space vehicles. The article emphasizes the obvious superiority of a telephonic system of communication, although this is of importance only in a manned space vehicle. But the problem of conversion has not yet been solved. The frequency band would have to be expanded by a good ten times in comparison with the frequency band used in the telegraphic system. To overcome interference this would require an increase in the power of the transmitter by several dozen times over current transmitter powers and the use of special methods for processing the signals. In the telephonic system it is impossible to overcome interference by lowering transmission velocity and narrowing the band width as was done for the automatic interplanetary station.

In the future the two-directional communication will be on two different wave lengths, one for Earth-Space and the other for Space-Earth. This will provide more reliable, instantaneous and flexible contact. Soviet scientists will not be long in overcoming the very difficult problems presently remaining unsolved. ("The Spaceship Speaks," by V. A. Sokolov, Nauka i Zhizn', No. 8, 1960, pp. 4-9)

Report on the Experimental Animals Aboard the June Soviet Ballistic Rocket

The ballistic rocket fired by the Soviets in June carried several experimental animals, the dogs "Otvazhnaya" and "Malek" and a rabbit named "Zvezdochka." The animals had undergone a special training period to accustom them to the unexperienced rigors of space travel -- weightlessness, extreme vibration, tight quarters, and special clothing. Actually, however, "Otvazhnaya" was making a fifth trip into space, and was therefore already a veteran. At an elevation of 208 km the nose cone of the rocket fell free and began its descent on a parachute. The dogs and rabbit were soon safe and sound on the surface, the former asking for sausage and sugar and the latter nibbling on grass. Valuable telemetric data will provide much needed data on the physiological reactions of animals during flight in space. ("A 'Veteran' Astronaut," unsigned article, Nauka i Zhizn', No. 8, 1960, p. 9)

III. UPPER ATMOSPHERE

New Names of Craters and Cirques on the Moon

The Commission of the Presidium of the Academy of Sciences of the USSR for Preparing Proposals for Naming Newly Discovered Features on the Reverse Side of the Moon has now met. In the course of the scientific study of the photographs of the reverse side of the Moon a number of new features were delineated which required the assignment of names. The commission regarded it as feasible at this stage of study to assign craters and cirques the names of outstanding scientists and cultural leaders: Giordano Bruno, Jules Verne, Hertz, Kurchatov, Lobachevskiy, Maxwell, Mendeleyev, Pasteur, Popov, Sklodowska-Curie, Tszu Chun-chzhi* and Edison.

The Presidium of the Academy of Sciences of the USSR confirmed the proposals made by the commission.

Materials connected with the work of the commission will be sent to the International Astronomical Union.

This article is accompanied by a sketch of the lunar surface; it shows the newly discovered features on the reverse side of the Moon. Features having a dark bottom are shaded; features with a less dark bottom are not shaded. New detail is shown within the Sea of Moscow or the Tsiolkovskiy and Joliot-Curie Craters. The dotted lines delineate the most important features on the part of the Moon visible from the Earth. ("New Names of Craters and Cirques on the Moon," Priroda, No. 5, May 1960, page not indicated)

* Russian transliteration.

"New Hercules 1960"

On the morning of 7 March 1960 a Norwegian amateur astronomer observed a new star of the fifth magnitude situated not far from the constellation Aquila. The Director of the Institute of Theoretical Astrophysics of the Norwegian Academy of Sciences immediately reported this to Copenhagen, where the Central Bureau disseminated the information to all observatories in the world.

Numerous spectrograms of this star have already been made at Soviet observatories in Abastuman (Georgian SSR), at the Crimean Astrophysical Observatory and at the southern station of the State Institute of Astronomy im. P. K. Shternberg; it has been photographed at many other stations.

Japanese photographs made before the new star was first noticed show that at the end of February the star was of less than the tenth magnitude and attained its maximum brightness on 4 March. Photographs made in Moscow show that by 27 March the magnitude had decreased to 6.3.

So-called "new" stars are apparently the result of nuclear processes in interstellar matter causing an instantaneous liberation of a great quantity of energy; the outer envelope of the star begins to expand rapidly -- with a velocity of several hundred kilometers a second. Such phenomena are rare -- the last being observed in 1950.

The article is accompanied by a photograph of the sky showing the "new" star on 11 March 1960; it was taken with the 400-mm astrograph of the Crimean Astrophysical Observatory. A second photograph is the spectrum of the "new" star, made on 13 March 1960 at the same observatory with a 1220 mm reflector with quartz spectrograph. ("Nev Hercules 1960," by N. P. Kukarkina, Astronomical Council, Academy of Sciences of the USSR, Priroda, No. 5, May 1960, pp. 62-63)

Full Translation of a Report on the Radioradiation of the Planet Jupiter

At a recent session of the astronomical colloquium at the State Institute of Astronomy im. P. K. Shternberg, conducted under the control of Doctor of Physical-Mathematical Sciences I. S. Shklovskiy, a report was given concerning the radioradiation of the planet Jupiter.

The radioradiation of that planet, only recently discovered, consists of three parts: thermal radiation, noted on the shortest waves ($\lambda \leqslant 3$ cm), with a temperature of about 150°K; 2) sporadic radiation on meter waves, associated with electrical discharges in the atmosphere of Jupiter, and 3) the most interesting -- constant radiation on waves of 3 to 70 cm. The latter manifest an increase in temperature with length of wave to $70{,}000^{\circ} \pm 30{,}000^{\circ}$K for $\lambda = 68$ cm.

The American radioastronomer Field has expressed the opinion that this radiation is the result of the motion of electrons in radiation belts around Jupiter and that planet's enormous magnetic field. A considerable value for the magnetic field is to be expected due to the rapid rotation of Jupiter and its large mass. Such radioradiation cannot be discovered on the Earth (because of the small magnitude of its magnetic field). However, the above-mentioned hypothesis runs into a number of substantial difficulties. The most serious of these difficulties is that we do not know the mechanism of acceleration of electrons around Jupiter. Cosmic rays and corpuscular streams coming from the Sun cannot provide the required number of particles. Other mechanisms which could be the cause of the observed radioradiation appear to be completely inadequate. The solution of the problem depends on continuing observations which will make it possible to check the correctness of the proposed theory.

("Riddle of the Radioradiation of Jupiter," by V. G. Kurt, Priroda, No. 5, May 1960, p. 62)

Report on the Byurakan Astrophysical Observatory

The popular magazine Ogonek has recently carried a well-illustrated feature article on the Byurakan Astrophysical Observatory. The director of this famed institution, still less than fifteen years old, is the well

known Soviet astronomer Academician V. A. Ambartsumyan. The staff is rather small, mostly made up of young people who have recently graduated from Yerevan State University. Nevertheless, many of them have already done interesting independent work.

The Deputy Director of the observatory, L. V. Mirzoyan, was asked to comment on what the most important discoveries made at the observatory have been and what the principal work was to be in the future. He stated that the observatory has specialized in research on the origin and evolution of stars and star systems and the physics of the cosmic state of matter. Also, it was only recently that Academician Ambartsumyan discovered star associations within our Galaxy. He has concluded that the star associations and the stars forming them are young formations. He has also concluded that the formation of stars is still going on, and that stellar associations are the foci of star formation in the Galaxy. The discovery of blue galaxies is another striking event in the history of the observatory. These are relatively young formations with a number of peculiarities distinguishing them from other star systems. In some cases they exhibit optical radiation of a nonthermal nature, probably not associated with thermonuclear reactions. This radiation sometimes has a clearly expressed bluish color.

Radiophysics and radioastronomy have recently been greatly emphasized at Byurakan. A new meter telescope is now being installed. The instrument construction laboratory, headed by G. S. Minasyan, is planning and assembling all the instruments and the unique radio apparatus for the observatory. The town of Saravand, somewhat above Byurakan, is the site for a large interference radio telescope, the pride of the laboratory.

The photo captions are as follows: (1) Academician V. A. Ambartsumyan; (2) The antenna of the radio telescope at Saravand; (3) In March of 1960 a new star flared up in the constellation Hercules. N. Ivanova and R. Oganesyan, scientific associates, measure its spectrum; (4) The comet Mrkos -- one of the brightest comets of 1957. Observations of this comet were conducted in Byurakan; (5) El'ma Parsamyan, a young astronomer, works on the problem of cometary gas nebulae. Observations are being made with a 21-inch Schmidt system telescope; (6) Erecting the dome of the tower for the new telescope; (7) L. V. Mirzoyan; (8) As one of the nearer galaxies, M 101, appears to us. Bright condensations of a whitish-blue color can be distinguished. These are star associations. ("Path to Space," by Dm. Bad'termants and V. Beletskaya, Ogonek, No. 32, August 1960, pp. 8-9)

IV. METEOROLOGY

25th Anniversary of the El'brus High-Mountain Expedition

A scientific meeting was opened yesterday in Nal'chik. It was devoted to the 25th Anniversary of the El'brus High-Mountain Expedition. On opening the session Academician Ye. K. Fedorov noted that the El'brus Expedition was faced with very complex scientific problems of very great practical importance. This is the problem of learning to control the weather. The staff of the Expedition, in collaboration with many of the country's scientific institutions, has made a scientific contribution to the study of atmospheric physics, one of the most important fields of scientific endeavor.

The Chief of the El'brus Expedition, Professor G. K. Sulakvelidze, delivered a report in which he pointed out that the Expedition in a period of 25 years had grown from a few small tents on the slopes of El'brus to a major scientific center.

At the evening session reports were heard from Professor I. A. Khvostikov ("The Work of the El'brus Expedition in the Field of Atmospheric Optics"), from Candidate in Physical-Mathematical Sciences Ye. I. Bocharov ("Investigation of the Transparency of the Atmosphere"), and Doctor of Physical-Mathematical Sciences S. F. Rodionov ("Work on Atmospheric Optics and Aeronomy on El'brus"). ("A Beginning to Weather Control," Pravda, 27 September 1960, p. 4)

A Fascinating and Provocative Study of the Relationship Between Solar Activity and Climate

The readers of Priroda have recently been treated to a stimulating 10-page article on the relationship between solar activity and climate. The author begins with an introduction, setting forth essential facts concerning the Sun and solar phenomena, including cyclical activity, but moves rather swiftly to the main subject of his paper -- how does solar activity influence the Earth's atmosphere?

In the years of maximum solar activity the Sun emits an extra large number of electrically charged particles -- corpuscles, which travel at a velocity of more than 1,000 km/sec; these speed through space and burst into the Earth's atmosphere. There is an extraordinary increase in the ultraviolet, Roentgen and radioradiation of the Sun. Exceptionally intense streams of corpuscles occur when there are chromospheric flares on the Sun.

On reaching the Earth's atmosphere, all forms of this energy are for the most part absorbed by the upper layers of the atmosphere and cause considerable disturbances in that medium. Among other phenomena, there are magnetic storms and auroras are visible in such places as Moscow, Khar'kov, Sochi and Tashkent. Geoactive radiation exercises an

influence on the high layers of the atmosphere and this is reflected in a substantial way on the general circulation of the atmosphere. This in turn influences the weather and climate of the entire Earth.

Post-war research, especially by Soviet scientists, has demonstrated that solar activity plays a decisive role in changes in the intensity and type of circulation of the Earth's atmosphere. It has been firmly established that there is an extraordinary intensification of the circulation of air masses in years of maximum solar activity. The author then devotes several paragraphs to generalizations about the general circulation of the atmosphere. He then brings out one of the main themes of his article -- the very high solar activity in recent years has given rise to unusually contrasting and stormy weather, and this atmospheric turbulency has caused many meteorological catastrophes all over the globe.

The interaction of solar activity and circulation of the atmosphere is being studied in the Climatology Section of the Institute of Geography of the Academy of Sciences of the USSR under the direction of Professor B. L. Dzerdzeyevskiy. Research done by the Institute indicates that what has previously been regarded as "anomalies" are actually variations in atmospheric processes and climatic elements which have a fixed pattern over a period of years. The work of the Main Astronomical Observatory of the Academy of Sciences at Pulkovo has established a relationship between solar activity and atmospheric circulation, thereby expanding and strengthening the basis for a method of making long-range weather forecasts.

In investigating the role of solar activity, the workers of the Arctic and Antarctic Institute, under the direction of Professors G. Ya. Vangengeym and A. A. Girs, have established laws governing the periodic change of the three principal forms of atmospheric circulation and the types of weather associated with them. They found that in years of minimum solar activity that there is a predominance of zonal movement of air masses from west to east; as a result the Northern Hemisphere has relatively calm weather, most closely resembling the long-period norms. In years of maximum solar activity there is a predominance of meridional movement of air masses (or zonal, but from east to west). With the onset of the second type of atmospheric circulation, there comes a period of heightened exchange of air masses between the polar regions and the tropics, the contrasts in temperature increase, and the weather takes on a turbulent character.

Precipitation has a clearly expressed 11-year cycle. This can be confirmed by investigations of tree rings and the bottom deposits of lakes, seas and oceans. This cycle can be traced for hundreds of thousands of years. It must be pointed out, however, that the cyclical activity of the Sun is not entirely constant -- the 11-year cycle varies from 9 to 14 years. Because of certain characteristics of the general circulation of our atmosphere, it does not everywhere react to this cyclical activity in the same way. The increasing intensity of atmospheric circulation causes floods and hurricanes in some areas of the Earth and severe droughts in others.

After an absolute minimum of solar activity in 1954, when not a single sun spot was observed, solar activity began to increase rapidly and by 1956 had exceeded the maximum reached in the preceding cycle in 1947. The absolute maximum of the current cycle was observed in the first months of 1958; it was the highest of the last 19 cycles. Evidently its maximum coincided with the maximum of the secular cycle of solar activity.

The laws involved in the relationships between the Sun and the troposphere were the center of attention for a conference held in Leningrad and at the Pulkovo Astronomical Observatory from 8 through 11 February 1960. Dozens of outstanding scientists presented papers dealing with this subject.

Until recently it was felt certain that the intensity of solar radiation was constant, but recent research, especially in meteorological rockets, has definitely demonstrated that the "solar constant" actually changes considerably. This, of course, is due to variations in solar activity.

Soviet scientists have attained notable successes in predicting the changes in solar activity and predetermining the times when maxima and minima will occur. This is of exceedingly great importance for meteorologists and geophysicists who will thereby have available information on which to base long-range predictions of many terrestrial phenomena. However, little has yet been achieved in the prediction of such short-term solar phenomena as chromospheric flares.

Professor B. A. Apollov, I. M. Soskin, and others have investigated the long-range variations in hydrological conditions in the Baltic, Barents and Caspian Seas. They have analyzed salinity and water exchange for the Baltic, ice conditions for the Barents Sea, and the level of the Caspian. They have discovered a close relationship between secular variations in solar activity and the hydrological conditions mentioned. It has been found that for periods of secular drop-off in solar activity the level of the Caspian is relatively high, ice conditions in the Barents Sea are severe, and there is a decrease in the salinity of the Baltic. This is due to a decrease in air temperature and a decrease in evaporation. The catastrophic drop in the level of the Caspian Sea during the last 30 years is related to the high activity of the Sun. Air temperature has increased, evaporation has intensified and the runoff in the Volga has decreased. In connection with the weakening of solar activity, the 1960's should bring a trend of decreased salinity in the Baltic, a higher level in the Caspian, and worsening ice conditions in the Barents Sea.

The last five-year period has been characterized by a whole series of severe meteorological catastrophes all over the Earth -- storms, hurricanes, floods and droughts. The author's research indicates that these are associated with the level of solar activity. A by far incomplete tabulation of meteorological catastrophes for 1955 gives a world-wide total of 40; for 1956 it was 100. This is not just a random phenomenon.

The article lists a good number of these calamities, as well as citing great extremes in temperature and precipitation occurring in this period in various parts of the world.

The author concludes that the number of meteorological catastrophes increases parallel with the rise in the curve of solar activity. If the total area of sun spots is taken into account, the coincidence will be complete.

Although solar activity is now on the wane, it is altogether probable that there will still be flareups in weather during the years 1960-1961.

The warming trend in the Arctic, associated with the secular cycle of solar activity, began in the 1920's; it will now probably come to a halt and gradually turn colder in the course of the next several decades. ("Solar Activity -- Weather -- Climate," by N. V. Kolobkov, Priroda, No. 8, August 1960, pp. 25-34)

V. OCEANOGRAPHY

Latest Report on the Vityaz'

The following is the full text of a recent news dispatch appearing in Ekonomicheskaya Gazeta.

The expedition vessel Vityaz' departed yesterday from its moorings at the port of Odessa. On the ship's chart there was a red line showing its projected route. It will pass through the Arabian Sea, the Bay of Bengal and the northern part of the Indian Ocean.

This is the second voyage of the Vityaz' into the Indian Ocean, so our correspondent was informed by I. M. Belousov, Chief of the Section on Expeditionary Work of the Institute of Oceanology of the Academy of Sciences of the USSR.

The vessel was in the waters of the Indian Ocean at the beginning of this year. The research begun then will now be continued.

Until recently the chart of the Indian Ocean showed areas a thousand miles across which were without any indication of measured depth. The first expedition exploring this part of the ocean discovered several underwater mountains up to 3.5 km in elevation, two new ranges each several hundred miles in length, and a great number of other ocean-bottom highlands. A gradual subsidence of the floor of the Indian Ocean was noted. ("The Vityaz' Again Sets Sail...," by N. Lazareva, Ekonomicheskaya Gazeta, 5 October 1960, p. 4)

Investigation of the Phosphorescence of the Sea

Priroda has recently reported briefly on research conducted aboard the expeditionary vessel Ob' during its voyages to and from the Southern Hemisphere on the Fourth Antarctic Expedition. This research was to determine additional characteristics of the little-studied phosphorescence of the sea.

The authors, associates of the Institute of Oceanology of the Academy of Sciences, point out that the phosphorescence of the sea is important for navigation, naval warfare and exploration for resources of fish and sea mammals. But, they continue, the solution of a great number of practical problems relating to the sea requires an understanding of the physical nature and the laws governing this phenomenon. Consequently, observations of the occurrence and intensity of marine phosphorescence in time and area was regarded as an important topic for investigation.

Observations were made from the upper deck of the Ob' at a height of 6 to 7 m above the water while the vessel was proceeding at a speed of 13-14 knots. In winter in the Northern Hemisphere not a single instance of phosphorescence was observed; in the tropical zones of the Southern Hemisphere only two cases were noted. Two months later, on returning from Antarctica by the same route, the phenomenon was observed frequently. Between 17 March and 13 April a total of 17 cases were observed in various climatic zones of both hemispheres.

The intensity and frequency of phosphorescence depend on the species and number of phosphorescent organisms and their season-to-season change. Phosphorescence is absent in the Northern Hemisphere in January because of the seasonality of plankton; this is best developed in spring and least developed in winter.

The article is accompanied by a significant graph showing phosphorescence in relation to temperature of the water at the surface, primary production and intensity of the waves. The intensity of phosphorescence bears a close relationship to water temperature and wave action. ("How the Sea is Phosphorescent," by V. G. Snopkov and V. M. Orinberg, Priroda, No. 8, August 1960, pp 97-98)

A Review of the Book "The Subjugation of the Deeps"

The following are some of the most important comments contained in a Priroda book review of the oceanographic study entitled "The Subjugation of the Deeps" (Pokoreniye glubin). This book, written by M. N. Diomidov and A. N. Dmitriyev, was published in Leningrad in 1959 by the State Union Publishing House of the Shipbuilding Industry; it contains 175 pages.

The book tells about the means presently available for studying the underwater world, life in the depths of the oceans, and the possibilities for future exploitation of ocean resources.

The authors first discuss methods for studying the sea from the surface, and then tell of methods involving such equipment as aqualungs, diving suits, bathyspheres, hydrostats and bathyscafes. Particular attention is paid to the latter. The chapter devoted to underwater photography in the reviewer's opinion leaves much to be desired in respect to completeness. The chapters on bathyscafes and hydrostats describe not only Russian, but also Japanese, French and American equipment. The reviewer objects to the incomplete description of the Soviet research submarine "Severyanka" and the failure to provide data on the first proposed Soviet bathyscafe. Failure to include information on the recent accomplishments of the "Trieste" may indicate that this book is already outdated.

A chapter entitled "Underwater Equipment of the Future" discusses the possibilities of bathyscafes and the idea of underwater trawlers. The final chapter deals with the exploitation of the sea in the future, but the author limits himself to information which is already known. The bibliography appended to the book is quite incomplete, especially in respect to foreign literature. The sketches are small in size and difficult to study.

The reviewer feels a new edition of this "useful" book will be required at a future date; he hopes it will contain more data on marine biology and the latest data on underwater equipment used in making observations. ("Techniques for Conquering the Underwater World," by Yu. P Shamenskiy, Priroda, No. 6, 1960, p. 120)

The Vertical Distribution of Zooplankton in the Black Sea

The vertical distribution of plankton in the sea is the result of a complex of causes of biological and hydrological nature. Individual factors may exercise a decisive influence on the distribution of plankton. To establish what factors governed the distribution of plankton in relationship to hydrogeological conditions the authors of the article cited below made simultaneous observations (about 1,000) of the vertical distribution of zooplankton at a greater number of horizons than in surveys made in the period 1951-1956.

The results of these measurements and consultation of existing literature made it possible to distinguish the presence in the Black Sea of two different complexes characterized by a specific seasonal vertical distribution. The qualitative and quantitative makeup of each complex was different.

In the warm season of the year, in the period of well-expressed stratification of water masses by density in the upper layers due to the temperature jump, the boundary between the two complexes was very clear. The more sharply expressed the jump layer, the sharper the boundary between the zones occupied by the two complexes.

The layer in which there is a change in temperature of 3 to 5 degrees/meter or more is to all intents and purposes an impassable barrier for almost all of the principal representatives of each of the complexes. A less pronounced change of temperature permits the passage of a small number of organisms from one zone to another.

In winter, under conditions of an intensive vertical circulation, the boundary between the zones occupied by the two different ecological complexes is absent -- both complexes intermix and are found in a single zone. The zooplankton is more or less evenly distributed through the water. This distribution of plankton is maintained throughout the greater part of the sea from approximately December through April.

With the onset of heating of the surface layers in the spring, and the resulting temperature and density stratification, there is simultaneously observed a stratification in the distribution of both complexes of organisms even though the boundary between the zones is still not clearly expressed.

Thus, the vertical distribution of ecological groupings of zooplankton in the Black Sea depends to a considerable degree on the vertical stability of the layers.

This article, written by associates of the Sevastopol' Biological Station im. A. O. Kovalevskiy, is notable for its solid content of experimental data and conclusions; the excerpts given above by no means exhaust the material provided in this paper. ("The Vertical Distribution of Zooplankton in the Black Sea," by T. S. Petipa, L. I. Sazhina, and Ye. P. Delalo, Doklady Akademii Nauk SSSR, 1960, Vol. 133, No. 4, pp. 964-967)

The Results of Determination of Primary Production in the Atlantic Ocean

Investigations of primary production in the surface layer of the ocean were made between November 1958 and April 1959 aboard the diesel-electric vessel Ob' on its fourth Antarctic voyage. Measurements were made by the method of determination of the isotope C^{14}, first used by E. Steemann Nielsen. The article describes the method used aboard the Ob' for collecting and processing the samples. Investigations were made along the entire route followed by the vessel (see map, Figure 1). Changes in primary production in relation to latitude are indicated on the important graph (Figure 2) based on data for 135 determinations. It shows that there are five zones in the Atlantic with varying productivity.

Because of the long duration of the voyage to and from Antarctica it was possible to determine seasonal changes in these zones. Exceptionally great changes were observed in the Northern Hemisphere where the interval between the measurements was 4 months. Supplementing Ob' data with measurements made aboard the Sedov, it appears that productivity in the vicinity of the English Channel decreases almost 20 times between spring and winter.

Primary production shown in Figure 2 for five zones in the Atlantic and one zone in the Antarctic is described in detail in the text. ("Results of Determinations of Primary Production in the Atlantic Ocean," by L. B. Klyashtorin, Institute of Oceanology of the Academy of Sciences, Doklady Akademii Nauk SSSR, 1960, Vol. 133, No. 4, pp. 951-953)

The Contributions of A. Ye. Kriss in the Field of Marine Microbiology

A thousand-word article appearing this June in the journal Priroda is a review of the scientific activities of one of the most outstanding Russian oceanographers, A. Ye. Kriss, whose most important contributions have been in the field of marine microbiology. Much has been written in the Soviet press about this eminent scientist because of his recent receipt of the Lenin Prize.

The article reviews the different areas in which he has worked, the new methods he has developed, and the new insight he has cast on the importance of deep-water marine microbiology. The article devotes several paragraphs to this specialized field of microbiology for the benefit of the uninitiated reader. Special attention is devoted to Kriss' work in study of the Black Sea. Most of the information in this article is contained in previous issues of Information on International Geophysical Cooperation -- Soviet-Bloc Activities. ("Tireless Investigator of the Depths of the Sea," by N. A. Krasil'nikov, Corresponding Member of the Academy of Sciences of the USSR, Priroda, No. 6, 1960, pp. 5-6)

VI. VOLCANOLOGY

Report on Eruption of Mud Volcano in the Caspian Sea

A recent report in Priroda gives an account of the eruption of a mud volcano in the Caspian Sea. The authors of the report are M. G. Agabekov and A. D. Sultanov, the latter an Academician of the Academy of Sciences of the Azerbaydzhan SSR. The two scientists are associates at the Institute of Geology of the Academy of Sciences of the AzSSR at Baku.

The explosion of the mud volcano on Makarov Bank occurred on 15 October 1958 and was accompanied by an unusually intense liberation of fire (see photo). The column of fire reached 200 to 250 meters above the waters of the Caspian and clearly lit up the entire southern shore of the Apsheron Peninsula. The smoke, illuminated by the flames, was seen as much as 80 km from the Makarov Bank. This mud volcano has erupted in 1906, 1912, 1917, 1921, 1925, 1933, and 1941. As a result of these eruptions highlands were formed in the vicinity of the Makarov Bank in the form of a truncated cone. The depth of the Caspian at this point is as much as 18 m, but these highlands have always formed at the time of eruptions, nearly reaching the surface and occasionally rising above it. But this cone of loose or viscous products has always been washed away quickly by the currents down to its very base.

After giving a rather detailed eye-witness account of the eruption, the authors point out that the mud volcano on the Makarov Bank is situated in the same folded zone which extends in a N-S direction and is the site of the great petroleum wealth of the Caspian area. The repeated explosions here are taken as an indication that inexhaustible reserves of petroleum and gas still remain unexploited in these folded structures. ("Volcano Amidst the Sea," by M. G. Agabekov and A. D. Sultanov, Priroda, No. 6, 1960, pp. 115-116)

VII. GLACIOLOGY

Report on the Glaciers of the Dzhungarian Alatau

The Dzhungarian Alatau are situated along the boundary between the Soviet Union and the Chinese Peoples' Republic. They constitute the most northerly range of the Tien-Shan, with some peaks rising above the 4,000 m mark. The range is capped with perennial snows and glaciers from which flow a great number of streams and rivers, most of them belonging to the Balkash basin. These rivers give life to many regions in southeastern Kazakhstan, being almost the only source of fresh water. Under such circumstances it is extremely important to have hydrological forecasts, but the Soviets found that this could be done only by studying the size and regime of the glaciers feeding the rivers of Dznungaria.

The total area of glaciation in the range is 1,100 to 1,200 km^2. The largest glacier is Berg Glacier, 8 km long; at least two others are as long as 7 km. The work of the Kazakh Academy of Sciences has been concentrated primarily in the central part of the northern slope of the range. To investigate the marginal parts of the range a students' scientific expedition was organized at the Leningrad Pedagogical Institute im. A. I. Gertsen. The expedition worked in the eastern part of the range in 1957 and in the western part in 1958. The bulk of the article contains details of the site, size, type, and physical characteristics of the glaciers in the area studied. The text is accompanied by four excellent photographs, but unfortunately there is no map; this is most regrettable because the article is rich in place names, many of them features which are newly named and others which may not be shown on maps of this remote area.

During the two seasons the expedition visited, described and named 70 glaciers with a total area of about 115 km^2. These glaciers constitute the remnants of a more extensive ancient glaciation. This is confirmed by terminal moraines found at elevations of 2,000 to 3,000 m, and also by the presence of U-shaped valleys.

Most of these glaciers are in a stage of retreat, but a few are stationary. ("Glaciers of the Dzhungarian Alatau," by Ye. V. Maksimov, Candidate in Geographical Sciences, Priroda, No. 6, 1960, pp. 87-89)

VIII. ARCTIC AND ANTARCTIC

February in Antarctica

February is the last summer month in Antarctica. The end of summer at the Mirnyy Observatory was characterized by a maximum air temperature of +5.2°. This was the highest air temperature at Mirnyy during the last five years. Meanwhile, at the stations in the interior of the continent it continued to be cold: at Vostok station the thermometer fell to -64°, at Komsomol'skaya station -- to -60.6°. The climate was "milder" at Lazarev station -- the February minimum air temperature there was -20.4°.

On 1 February 1960 the members of the Fourth Soviet Complex Expedition left the shores of Antarctica aboard the diesel-powered "Kooperatsiya."

From the very beginning of their stay on the Antarctic continent the Fifth Complex Expedition began to make ready for a spring expedition into the interior of the continent. The eastern sled-tractor train left for Komsomol'skaya station to deliver fuel for this expedition.

The western sled-snowcat train suspended operations at 70°24'5" S. and 12°44' E. on 10 February; personnel of the train were evacuated to Lazarev station.

Foreign specialists are participating in the work of the Fifth Complex Expedition, as they did in preceding expeditions. In the meteorological detachment the Czechoslovak meteorologist O. Kostka is working as a forecaster. The group of meteorologists from the German Democratic Republic is headed by Dr. G. Skayb*. The American seismologist Gilbert Duart flew with Soviet glaciologists to the Western Shelf Ice. While enroute from Lazarev station to Mirnyy the Soviet polar specialists made a landing at the Japanese station Showa and the Australian station Mawson; they were warmly received.

In February an aircraft assigned to the Belgian King Baudouin station arrived at Lazarev carrying Prince de Lin*, one of the members of the Belgian group saved by the aircraft piloted by airman Petrov. ("News from the South Polar Continent," by Yu. V. Khmarskaya, Interdepartmental Commission for the Study of the Antarctic, Priroda, No. 5, May 1960, p. 69)

* Russian transliteration.

May in Antarctica

The members of the Fifth Antarctic Expedition are carrying on their research during the harsh months of autumn and winter. The mean temperature in May at Mirnyy Observatory was -17.8°, at Lazarev station -18.6°, and at the interior station Vostok, -67.8°; the minimum temperature at Vostok was -78.7°.

Seismologists at Mirnyy Observatory recorded powerful shocks from the Chilean earthquake. This quake was recorded on 22 May at Vostok station. The Czechoslovakian scientist Praus is participating in seismic observations at Mirnyy.

The penetration of the sled-tractor train of Soviet glaciologists into the Antarctic interior continued during May. The speed of movement of the Antarctic ice mantle was determined along the profile between Mirnyy and Km. 50.

The Fifth Antarctic Expedition set up three temporary movable weather stations: "Druzhba" -- on the Western Shelf Ice, "Pobeda" -- on an ice island to the north of the Shackleton Shelf Ice (Pobeda Island is about 80 km long, 30 km wide and up to 60 m high); and a third, "Mir," on Drigal'skiy Island. The research conducted at these stations will yield valuable climatic data for the coastal regions of the Antarctic continent. At the end of May these stations were lashed by an intense snow storm: winds reached 25-35 m/sec and the thermometer dropped to -32°.

Among the icebergs near Mirnyy there is a colony of Emperor penguins consisting of 20,000 birds. In May they were exceedingly active in laying eggs and the hatching out of the small birds will begin in the middle of the Antarctic winter. ("News from the South Polar Continent," by N. A. Lepilova, Interdepartmental Commission for the Study of the Antarctic, Priroda, No. 8, August 1960, p. 76)

Latest Report from Mirnyy

The following information was radioed from Mirnyy under a September 27 dateline.

In the last 25 days at Mirnyy there has only been one day on which aircraft could take off. The winds during this time have been very violent. The unfavorable weather conditions have delayed the commencement of field research. No actual work in the field has been undertaken, but base preparations are proceeding at full speed. As soon as the weather calms an LI-2 aircraft piloted by A. T. Barabanov will take off for Lazarev, transporting a scientific team headed by D. S. Solov'yev which will undertake geological, geographical and glaciological work in Queen Maud Land. Scientists and airmen will seek out a site for a new station in that area.

The transport detachment is almost ready to make its way into the heart of the continent. The detachment, headed by B. A. Krasnikov, is finishing the repair of tractors which will move to the Vostok station. The glaciologists, headed by V. B. Ivanov, are ready to undertake work on the Western Shelf Ice, Pobeda Island and in Queen Maud Land.

The aerometeorological detachment is continuing its work, despite the disaster which occurred two months ago. Under the direction of B. A. Deryugin, a young meteorologist, and with the assistance of the entire station complement, regular aerological, meteorological and actinometric measurements are being made.

As soon as weather permits the station's aircraft will be off in all directions to make aeromagnetic surveys, take aerial photographs and make reconnaissance of the weather and of ice conditions at sea.

("It Will Soon Be Spring in Antarctica," by Ye. Korotkevich, Chief of the Fifth Antarctic Expedition, Izvestiya, 27 September 1960, p. 6)

Ten-Page Article Reviews Soviet Accomplishments and Aspirations in the Antarctic

A lengthy article appearing in the August 1960 issue of Priroda is entitled "The Study of the Antarctic is Continuing." Unfortunately the title is misleading, and the text contains virtually nothing pertaining specifically to Soviet activities on that continent at the present time.

The first section, entitled "After 1 and 1/2 Centuries," deals in generalities, but contains the following interesting commentary: "The discovery of all the secrets of Antarctica and making them accessible to all the people of the world is too much for only one country to do, or for a few to do. The Antarctic must be the scene of extensive activity with the genuine cooperation of the scientists of many countries."

The second section, "Soviet Polar Specialists -- Science," is merely a sketchy review of the scientific stations established by the USSR in the Antarctic. It mentions that only three of the eight stations listed are operated all year -- Mirnyy, Vostok and Lazarev. A table lists the height above sea level of each of the eight stations.

The third section, "The Arctic Served as a Good School," includes a history of Russian exploration and research in the Arctic. It points out that the vast experience accumulated by the Soviets in the Arctic was invaluable in dealing with the Antarctic: experience and personnel were on hand to cope with the problems found there where conditions are more severe than in the north polar regions.

The fourth section, "The First Great Results," contains much data, but little that is new. The Third Antarctic Expedition, it points out, finally established that the Antarctic ice cap lies over a continental land mass, not an archipelago. The mean thickness of the ice is about 2.5 km and the total quantity of ice on the continent is about 30 million cubic kilometers. If all the ice on that continent were to melt the level of the ocean would probably rise by 100 meters. The "mystery" of the Banger Oasis was solved. The absence of ice there in the summer time is due to peculiarities of the subglacial relief, creating favorable conditions for the outflow of ice into surrounding subglacial depressions. Air temperatures at the surface in the Banger Oasis attain +12° in summer. Meteorological observations, including the launching of over 3,000 radiosondes, demonstrated, among other things, that the dynamics of atmospheric pressure in Antarctica are basically different than in the Northern Hemisphere. It was discovered that the shoreline of Wilkes Land is actually dozens of miles farther south than shown on maps. Other important map corrections were made. Glaciological research was exceptionally fruitful, especially in such matters as the processes of transformation of snow into ice and determination of the rate of movement of Antarctic ice from the interior to the coast.

The fifth section, "In the Interior of the Icy Continent," contains many details concerning the difficulty of movement and life itself in the interior. Certain important data is given on cross-country movement conditions on different types of snow and ice. A valuable paragraph describes the Soviet "Khar'kovchanka" cross-country vehicle, a machine of 500 HP with meter-wide treads. Traverses made by sled-tractor trains are described, as are the most important flights made by Soviet airmen.

The sixth section, "Twelve Countries are Studying the Antarctic," deals with non-Soviet activities, not falling within the scope of this review.

The seventh and final section, "New Goals," contains only sketchy and outdated information. ("The Study of the Antarctic is Continuing," by V. D. Novikov, Priroda, No. 8, August 1960, pp. 43-52)

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